**Balance Sheet Strength and Strategic Management in the Oil and Gas Industry**


## Abstract

We investigate how accounting can support strategic decision-making in the dynamic context of cyclical industries where risk is the nature of business. We conduct our analysis in the context of the Canadian Oil and Gas (O&G) Industry. Based on our discussions with industry leaders, analysis of company disclosures, and reviews of industry reports, business and academic articles, we identify two strategies that are prevalent in the O&G industry – an aggressive strategy that invests heavily in growth periods and a conservative strategy that invests less in growth periods to build and sequester resources for decline periods. We use a long-term measure of balance sheet strength based on cash flows to debt to discriminate across these two strategies. We find that companies that are more conservative (lower debt to cash flows over time) achieve higher operating efficiency in general and that their efficiency advantage is greater in post-crisis periods following sharp price declines. We also document that conservative firms invest more in post-crisis periods and that their acquisitions yield significantly more reserve quantities per dollar of investment than other companies, especially in the post-crisis periods.



**Keywords:** balance sheet strength, cyclical industries, oil and gas

## 1. Introduction

An entity's long-term performance depends on its ability to not only avoid risk but to transform risk into competitive advantage (EY, 2017). This capability "is increasingly important as the business environment becomes more uncertain and the pace of change accelerates" (COSO, 2016, p3). "In order to be relevant and successful in the long-term, [the accounting] profession has to go beyond the historical perspective and mitigating risk, and become more future-oriented and proactive in identifying and taking advantage of opportunities" (CPA Canada, 2017, p2). While the profession recognizes the need for accounting to take a more strategic role in transforming threats into opportunities, there is little academic research to help guide this transition. The purpose of our paper is to investigate how accounting can support strategic decision-making in the dynamic context of cyclical industries where risk is the nature of business.

The Canadian Oil and Gas Industry provides an ideal setting for this analysis because it experiences shifts in the balance of supply and demand that result in periods of rising and declining prices of uncertain amplitude and duration (see figure 1). Also, given the commodity nature of the upstream O&G industry, the price cycles are not heavily influenced by product innovations that may change the competitive landscape, enabling us to focus on the uncertainty associated with industry economic cycles as opposed to product life cycles. While there is diversity in terms of the types of oil (light versus heavy oil) and the extraction technologies (conventional wells versus oil sands), the price effects are similar for all exploration and production (E&P) companies.

To learn about strategic management in the Canadian O&G industry, we talked with senior financial executives (chief financial officers or CFOs), senior partners of audit firms with

O&G specializations, industry consultants and analysts. We also read descriptions of strategies in annual reports, industry and financial magazines, and articles written on cyclical industries in both the business press and the academic literature. Our discussions and reading led to the identification of two strategy types that we label “aggressive” and “conservative”.

Companies that follow an aggressive strategy invest heavily during growth periods, relying on external financing to support their strategies. Companies that follow a conservative strategy invest less heavily in growth periods and build financial strength to see them through decline periods. The fact that both strategies are observed indicates that there are advantages and disadvantages associated with each strategy. Aggressive companies earn market rewards for growing during up-cycles but run the risk of over-commitment when a down cycle hits them. Conservative companies forego some of the market rewards of expansion in an up-cycle but are better positioned to survive a prolonged down-cycle. Importantly, we found that companies that follow a conservative strategy focus their attention on maintaining balance sheet strength defined by the level of operating cash flows to debt.

Strategic management involves utilizing resources to enhance the performance of firms in their external environments (Nag et al. 2007). We use data envelopment analysis (DEA) to measure the operating efficiency of companies using quantity of oil and gas produced (barrel of oil equivalent or BOE) as outputs and total O&G production expenses, general and administrative expenses (G&A), depreciation, depletion and amortization (DD&A) as inputs. The score produced from our DEA analysis provides a relative measure of operating efficiency benchmarked against the efficient frontier – the operating efficiency realized by the most efficient companies in the sample (Banker et al., 1984; Demerjian et al, 2012).

Using a two-stage DEA approach (Banker and Natarajan, 2008), we run a second-stage regression that relates the operating efficiency score obtained in the first stage to our measure of conservatism and other factors that may affect operating efficiency. Thus, in the second stage, we include an indicator variable for conservative financial policy based on cash flows to debt over the tenure of the firm in the sample. We also include indicator variables for post-crisis periods that we interact with the conservative variable to see whether conservatism affects production efficiency differently in decline stages versus growth or stagnant stages. In terms of operating efficiency, we find that conservative companies outperform aggressive companies in general and that this advantage is enhanced during the post-crisis period.

To validate the identification of conservative firms based on cash flows to debt over time, we investigate whether conservative firms make a higher proportion of their capital expenditures in decline stages as opposed to aggressive firms. We find that capital expenditures relative to total assets are lower in general for conservative firms but that the relative magnitude of capital expenditures to total assets is higher for conservative firms in the post-crisis periods than in other periods. We also test whether conservative companies get higher value for their investments by relating the value of proven oil reserves acquired to the level of capital expenditures. We find that the value of proven oil reserves acquired is on average significantly greater for conservative firms versus aggressive firms and that this investment advantage is significantly enhanced following the 2014 drop in prices.

Together, our results from data analysis support our findings from interviews and other sources that companies in the Canadian O&G industry follow two distinctive strategies. We also learn through our data analysis that a conservative strategy played by maintaining higher levels of cash flows to debt leads to higher operating efficiency in general and that this advantage is

even greater in decline periods. Our analysis indicates that higher operating efficiency results from making better acquisitions – obtaining greater quantities of proven oil reserves per dollar of capital expenditure.

In the next section, we describe the methods we used to identify strategy types in cyclical industries. In the third section, we describe the research design that we use to evaluate the alternative strategies based on analysis of data. In the fourth section, we describe the data and the results obtained by estimating the empirical models. In the final section, we draw conclusions from our analysis and identify avenues for future research.

## 2. Strategic Management in Cyclical Industries

### 2.1 Industry Economic Cycles

Industry economic cycles are caused by exogenous and endogenous forces that upset the balance of supply and demand. They are comprised of periods of growth and prosperity mingled with periods of decline and anxiety (Zarnowitz, 1985; Mathews, 2005). Different from the traditional product life cycle, which is characterized by innovation, growth, maturity and decline, the industry economic cycle is characterized by periods of growth and decline that are unpredictable in terms of timing, amplitude and duration. When making strategic decisions, managers in cyclical industries must deal with risk due to uncertainty about the timing, duration and amplitude of industry economic cycles (Mascarenhas & Aaker, 1989). There are strong market incentives to invest in a growth stage but looming risk that companies will be caught with high resource commitments when cash flows drop off in a decline stage.

Managing through such cycles has many dimensions and complexities. Of 50 companies listed in the oil and gas index 20 years ago, only a few remain today (Van Wielingen, 2015). Little previous research has considered how managers make decisions about capital investment

in relation to financial strength and how those decisions influence firm performance for companies operating in cyclical industries (Bromiley et al., 2008). “One of the unexplored areas of business dynamics is how the cyclical behavior of certain important industries poses strategic issues for incumbent firms as well as challengers” (Mathews, 2005, p.6).

### 2.2 The Canadian Oil and Gas Industry

The Canadian Oil and Gas Industry provides an ideal setting for this analysis. The Canadian O&G industry has faced extraordinary challenges during the past fifteen years (see figure 1). The shifts in the balance of supply and demand results in periods of rising and declining prices of uncertain amplitude and duration. From 2003 to 2008, the oil prices increased significantly to around $136/bbl driven by political and economic factors (Deutsche Bank, 2013). Then, the O&G industry experienced major challenges posed by the demand-driven price decline after the global economic crisis in 2008, when oil prices dropped dramatically to $31/bbl (Deutsche Bank, 2013). The industry then experienced a long run-up in oil prices followed by a sharp downturn due to the supply-driven price collapse in late 2014.

Given the commodity nature of the upstream O&G industry, price cycles are not heavily influenced by product innovations, enabling us to focus on the uncertainty associated with industry economic cycles as opposed to product life cycles. We take advantage of proximity and access to executives and other managers at leading O&G companies to inform and enrich our empirical analysis.

### 2.3 Strategic Management and Balance-Sheet Strength

“Among the most difficult firm strategic choices is the trade-off between making a long-term commitment or holding off on investment in the face of uncertainty” (Smit and Trigeorgis, 2017, p.2555). The frequency and intensity of the industry economic cycles makes

this "trade-off: question particularly salient from a strategic management perspective. Managers of E&P companies must make investments to grow and survive but need to navigate the industry economic cycles that influence the amount and timing of future cash flows.

Through discussions with industry participants and reading of various reports and disclosures, we identified two strategies that are prevalent in the oil and gas industry. Some companies invest aggressively during the growth phases of industry economic cycles. Those firms use up their investment capability and financial resources to expand and grow in up-cycles – making hay while the sun shines. Charger Energy Corp. (formerly Seaview) indicated that "Seaview's goal is to create sustainable and profitable growth in production and cash flow. To accomplish this, Seaview has, and will continue to pursue, aggressive, yet focused, acquisition, exploration, exploitation and development opportunities" (Seaview 2010 Annual Information Form, p.7). Similarly, PetroNova Inc. stated that "the Corporation's strategy is to develop its existing portfolio of assets and to pursue further exploration opportunities" (PetroNova Inc. 2014 Annual Report, p.3).

At the same time, some firms adopt a conservative strategy and invest less heavily during growth phases to build their investment capability and financial strength (saving for a rainy day), which enables investment and purchase of properties in the decline phases. "A strong balance sheet is expected to help us achieve our growth goals and withstand the ups and downs of the crude oil price cycle" (Suncor Energy Inc, 2003 Annual Report, p.14). "Despite the commodity price volatility and recessionary pressures, our balance sheet remains strong and we continue to employ a conservative capital structure" (Encana Corporation, 2009 Annual Reports, p.12).

Companies that follow a conservative strategy focus their attention on maintaining balance sheet strength defined by the level of cash flows to debt. "Tight management of debt and

reducing cash flow risks through strategic hedging programs will be key to maintaining a strong balance sheet" (Suncor 2005 Annual Report, p.6). DBRS's, a major Canadian credit rating agency, report titled "Rating Oil and Gas Companies" indicates that "While DBRS recognizes the importance of traditional debt-to-capital ratios as an indicator of financial leverage, the capitalized value of property, plant and equipment and book equity values may not be reflective of the true underlying value of oil and gas reserves in the ground. As a result, DBRS tends to place greater emphasis on debt-to-cash flow, interest and fixed-charge coverage ratios as measures of balance-sheet strength." (DBRS, 2009, p. 16)

An interesting and unexplored question is whether firms that follow an aggressive strategy to take advantage of high prices in an up-cycle outperform companies that follow a conservative strategy that builds financial strength during up-cycles. The fact that both aggressive and conservative strategies are observed indicates that there are opportunities and threats associated with each strategy. Aggressive companies earn market rewards for growing during up-cycles. An aggressive company that experiences sustained growth and hits only minor decline periods would earn high cumulative returns. However, firms that have invested aggressively and compromised financial strength may spin into financial distress when a crisis hits. They may have to sell some of their assets in order to raise cash and satisfy debt requirements.

Conservative companies forego some of the market rewards of expansion in an up-cycle but are better positioned to survive a prolonged down-cycle. They may even take advantage of a decline periods to acquire assets at low prices from over-committed aggressive companies that have to sell assets at distressed prices. "We strengthened our balance sheet during the high oil price environment of 2011 to 2014, while others were making unsustainable spending decisions

and leveraging up. We knew it was time to prepare financially for the inevitable downturn in prices and the profitable growth opportunities that would emerge. This action was critical to our current success" (Suncor Energy 2016 Annual Report, p.3). "Our disciplined, prudent approach and unparalleled financial strength will enable us to take advantage of a period of decreasing costs and improving labour productivity as we invest in our future" (Imperial Oil Limited, 2008 annual report, p.2). "Balance sheet strength allows us to capitalize on opportunities as they arise and demonstrates the sustainability of our business model through commodity cycles" (Encana Corporation 2013 sustainability report, p.17).

Exploration and production (E&P) companies that invest in growth cycles pay more to acquire and develop oil reserves but reap the benefits of higher prices when they produce and sell their oil. They also have strong capital market support to fund their investments. They hope that O&G prices will remain high for a sufficiently long period of time that they can recover much of their investment before a sustained downturn occurs. E&P companies that invest in down cycles pay less to acquire and develop reserves but must sell at low prices to get cash flows from their investments in the short run. They may benefit from investing in a down market over the long term.

To investigate whether companies that follow a conservative strategy achieve higher operating performance, we relate production efficiency to a variable that discriminates between aggressive and conservative firms. Because income-based measures of operating performance are sensitive to oil prices, we use a frontier-based measure of operating performance estimated using data envelopment analysis (DEA). We state our research hypothesis as follows:

H1: Companies that follow a conservative strategy obtain higher operating efficiency than companies that follow an aggressive strategy.

## 3. Research Design Based on Data Analysis

### 3.1 Identification of Conservative Firms

We used the ratio of cash flows to debt to classify firms as conservative or aggressive with respect to their investment and financing strategy. This approach has advantages over the traditional balance sheet debt to equity approach because it reflects the relation between debt financing and operating income or cash flows. Companies that are aggressive invest available capital, companies that are prudent delay investing available capital. Therefore aggressive companies would have lower cash flows to debt. However, conservative firms invest prudently (leave some capital available), so they will be characterized by higher cash flows to debt. This measure represents a firm's ability to service debt from operating cash flows reflecting the firm's financial strength and flexibility. To avoid short-term effects, we used a ranking mechanism based on cash flows to debt over the full tenure of the companies in our sample period to identify firms as conservative or aggressive.

For each year, we rank firms based on the ratio of total operating cash flows to debt and assign a percentile rank to the firm for that year. Then, for each firm, we sum the percentile ranks for all years that the firm is included in the data and compute the average percentile rank of the firm for the firm's full tenure during the sample period of 2002 to 2016. We classify firms that are, on average, above the 50th percentile as firms following a conservative strategy and other firms as following an aggressive strategy. The strategy-type indicator is a dummy variable denoted as "conservative" = 1.

### 3.2 Analysis of Production Efficiency

We apply data envelopment analysis (DEA) to obtain efficiency scores that measure productive efficiency relative to other firms. DEA is a frontier-based non-parametric method for

benchmarking productive efficiency against similar firms (Charnes, Cooper and Rhodes, 1978). We follow the two-stage DEA approach described by Banker and Natarjan (2008), using DEA followed by regression analysis to evaluate how contextual variables affect productive efficiency. This approach yields consistent estimators of the impact of the contextual variables on productive efficiency.

Our efficiency scores are estimated using input-oriented variable returns to scale DEA (Banker, Charnes and Cooper, 1984). Outputs are oil and gas production in barrels of oil equivalent or BOE. Inputs are total production expenses, general and administrative expenses, depreciation, depletion and amortization. All costs items are deflated by the Canadian CPI index corresponding to the reporting month end. We log-transform all input and output variables. We estimate the efficiency score for all observations in the sample period (2002-2016) for exploration and production upstream firms. To mitigate the effect of outliers, we first estimate a pooled DEA model, and exclude observations with super-efficiency (efficiency greater than 1.2) scores as described by Banker and Chang (2006).

In the second stage analysis, we relate the efficiency scores obtained using DEA to contextual variables that may influence productive efficiency including the conservative indicator variable. We also interact the conservative variable with indicator variables for periods of price decline, including the years following the 2008 financial crisis where demand fell relative to supply and the years following the 2014 supply-driven oil price decline. Thus, we investigate whether companies that follow a conservative strategy achieve higher operating efficiency than other companies and whether an efficiency advantage for conservative firms is greater in the price-decline periods.

### 3.3 Analysis of Capital Expenditures

To evaluate whether firms that are classified as conservative based on balance sheet strength (debt to cash flows as described above) do follow a conservative strategy by investing relatively more in decline periods, we analyze the pattern of capital expenditures (scaled by total assets) for firms classified as following a conservative strategy relative to the pattern of capital expenditures for those classified as following a more aggressive strategy. Finding evidence of positive shifts in relative investment by conservative firms during the post-crisis periods would be consistent with a conservative strategy.

### 3.4 Analysis of Acquisition of Proven Reserves

If conservative firms take advantage of opportunities to purchase oil reserves from distressed aggressive firms at bargain prices in down cycles, the conservative firms would, on average, obtain greater reserves per dollar of capital expenditure than other firms. Conservative firms may also buy more carefully in all periods. We test whether conservative firms acquire more reserves per dollar of capital expenditure than other firms and whether this acquisition advantage is higher in decline periods following the two recent crises that sent oil prices in a downward spiral.

We estimate an empirical model that includes the log of acquired reserves as a dependent variable and the log of capital expenditures as an independent variable. Then, the conservative indicator variable and its interactions with time period indicators pick up information about differences in acquisition of reserves relative to capital expenditures between the conservative and aggressive firms, enabling us to test whether conservative firms buy better than other firms.

## 4. Sample Description and Results Of Data Analysis

Our sample is comprised of public Canadian O&G firms over the period from 2002 to 2016. We get annual and quarterly financial data from the CanOils Database, "which is the leading commercial database for Canadian O&G exploration and production firms" (Badia et al., 2016, p.12). CanOils provides historical financial data of Canadian O&G firms listed on the Toronto Stock Exchange (TSX), the TSX Venture Exchange or on a U.S. exchange from the period of 2002 to 2016. In addition, CanOils includes O&G production and reserve data for companies following National Instrument 51-101 "Standards of Disclosure for Oil and Gas Activities". O&G financial data and production data are available at a quarterly frequency, and the reserve reconciliation data including acquisition of O&G reserves is available at an annual frequency.

We begin our sample construction from all quarterly and annual observations obtained from Canoils. To increase comparability, our study focuses on upstream O&G companies specializing in exploration and production (E&P) activities. Therefore, we delete observations with more than 5% of total revenue generated from non-exploration and production activities, such as refining, marketing, field gathering, trading or sales (Barth et al., 2016). We exclude observations with zero production and remove quarterly or annual observations that are missing key financial variables (total assets, net capital expenditure, operating cash flows, total debt, book to market, debt to equity), leading to a sample of 7,473 firm-quarter observations. We also remove 1,009 observations with super-efficiency (> 1.2) scores (Banker and Chang, 2006) to arrive at a final sample of 7,150 firm-quarter observations. Following a similar set of procedures for annual data and requiring disclosure of reserve reconciliations, we obtain 1,954 firm-year

observations. We remove 261 observations with super-efficiency scores (> 1.2) to obtain a final sample of 1,693 observations.

Descriptive statistics are presented in table 1. Panel A provides descriptive statistics for the full sample. Panel B describes descriptive statistics for the aggressive and conservative investment strategies.

**4.1 Analysis of Efficiency Scores**

Table 2, column (1) reports the results from an OLS regression of firm efficiency *ln(score)* on the conservative strategy indicator and control variables. In this model, we include an indicator variable for conservative financial policy based on our analysis of cash flows-to-debt over the tenure of the firm in the sample. We also include indicator variables for post-crisis periods that we interact with the conservative variable to see whether conservatism affects production efficiency differently in decline stages versus growth or stagnant stages. We include time fixed effects for each quarter to effectively capture responses to price changes and other unobservable industry and economy-wide shocks for each quarter. We include proxies of book-to-market ratio and debt-to-equity ratio to control for growth and leverage (Obreja 2013), and operating cash flows to total assets (OCF/TA) to control the profitability. Standard errors in the model are clustered by firm to accommodate our panel data structure. All continuous variables are winsorized at the levels of 1% and 99% in all of our analyses.

From table 2, column (1), we see that the estimated coefficient of *Conservative* is statistically significant and positive ($\beta$ = 0.116, t statistics = 0.031). A positive association between *Conservative strategy* and efficiency score suggests that conservative companies outperform aggressive companies in general in terms of operating efficiency. We also see that the estimated coefficient of *Conservative*Post 2008 Financial Crisis* is significantly positive ($\beta$

= 0.087, t statistics = 0.024) and the estimated coefficient of *Conservative*Post 2014 Financial Crisis* is significantly positive ($\beta$ = 0.092, t statistics = 0.041). These two estimated coefficients represent incremental increases in operating efficiency of *Conservative* firms by 8.9% and 9.9%, respectively in the two post-crisis periods, suggesting that the advantage of conservative firms is enhanced during the post-crisis periods.

**4.2 Analysis of Capital Expenditures Relative to Total Assets**

To validate the identification of conservative firms based on debt to cash flows over time, we investigate whether conservative firms make higher capital expenditures in decline stages as opposed to aggressive firms. Table 2, column (2) reports the results from an OLS regression of firm's capital expenditures relative to total assets on the conservative strategy indicator and control variables. As in the previous model, we include an indicator variable for conservative financial policy and indicator variables for post-crisis periods. We find that the estimated coefficient of *Conservative* is statistically significant and negative ($\beta$ = -0.026, t statistics = -0.009), indicating that capital expenditures relative to total assets are lower in general for conservative firms versus aggressive firms.

We find that the estimated coefficient for *Conservative*Post 2008 Financial Crisis* is significantly positive ($\beta$ = 0.023, t statistics = 0.011) and the estimated coefficient of *Conservative*Post 2014 Financial Crisis* is significantly positive ($\beta$ = 0.025, t statistics = 0.010). These results suggest that the relative magnitude of capital expenditures to total assets is higher for conservative firms in the post-crisis periods than in other periods. These findings indicate that the conservative financial strategy is associated with conservative investment.

### 4.3 Analysis of Acquisition of Proven Reserves

We also test whether conservative companies get higher value for their investments by relating the value of proven oil reserves acquired during a year to the level of capital expenditures. Results of this analysis are presented in table 3. We estimate seemingly unrelated regressions with equations for the amount of acquisition of proven reserves *ln(Ac. Proven)* and the net capital expenditure *ln(Capex)*.

*Seemingly Unrelated Regression Equations*

$$\begin{cases} (1) ln(Ac.Proven) = \alpha_1 ln(Capex) + \alpha_2 Conservative + \alpha_3 Conservative * Post2008 \\ \qquad\qquad + \alpha_4 Conservative * Post2014 + \lambda_t + \varepsilon_{it} \\ (2) ln(Capex) = \beta_1 Conservative + \beta_2 Conservative * Post2008 \\ \qquad\qquad + \beta_3 Conservative * Post2014 + \gamma_t + \omega_{it} \end{cases}$$

Table 3, column (1) presents the results for seemingly unrelated regression equation (1) and Column (2) presents the results for equation (2). The coefficient on *ln(Capex)* in Column (1) is 0.827 (t statistic = 0.096), suggesting that a 1% increase in capital expenditures is associated with 0.83% increase in the acquisition of proven reserves. In Column (1), the coefficient on *Conservative* is 1.768 (t statistic = 0.724), suggesting that given the amount of capital expenditures, conservative firms, on average, acquire 1.77 times more proven reserves. The results suggest that that the value of proven oil reserves acquired is on average significantly greater for conservative firms versus aggressive firms. The efficiency in acquisitions increase in the post 2014 price decline. In this period, the conservative firms acquire more than 4 times (1.768 + 2.367) the proven reserves of the aggressive firms that spend the same amount on capital expenditures, suggesting that the investment advantage of conservative firms is significantly enhanced following the 2014 drop in prices.

Together, our results from data analysis support our findings from interviews and other sources that companies in the Canadian O&G industry follow two distinctive investment strategies. We also learn through our data analysis that a conservative strategy played by maintaining lower levels of debt to cash flows leads to higher operating efficiency in general and that this advantage is even greater in decline periods. Our analysis indicates that higher operating efficiency results from making better acquisitions – obtaining greater quantities of proven oil reserves per dollar of capital expenditure.

**4.4 Robustness Test Using Split Sample**

We also conducted supplementary analyses to assess the robustness of our findings. We estimate a regression of firm *ln(score)* on continuous firm-level average of OCF-to-Debt. We partition samples into two groups: OCF-to-Debt>0, OCF-to-Debt<0 to capture differences between firms with positive and negative operating cash flows. The results of this analysis are presented in table 4, with the positive OCF-to-Debt group in Column (1) and the negative OCF-to-Debt group in Column (2).

We find that the estimated coefficient of *Post 2014 Price Decline*ln(OCF-to-Debt)* is significantly positive 0.049 (t statistic = 0.021) in Column (1), indicating that firms with higher OCF-to-debt (more conservative) achieve higher efficiency in the post-decline period. The estimated coefficient of *Post 2014 Price Decline*ln(OCF-to-Debt)* is significantly negative -0.026 (t statistic = -0.014) in Column (2) indicating that a decrease in negative cash flows is associated with improvement in production efficiency in the post-2008 financial crisis period. Although the statistical significance varies, the coefficients are consistent with the predicted signs from the main results.

## 5. Conclusion

Our research investigates how accounting can support strategic decision-making in the dynamic context of cyclical industries where risk is the nature of business. Based on interviews with O&G industry insiders and descriptions of investment behavior in financial reports and other places, we identify two primary strategies – an aggressive strategy that takes advantage of growth when the market is strong and a conservative strategy that builds resources in up-cycles to better survive down-cycles and potentially take advantage of investment opportunities in down-cycles. From our discussions and literature search, we find that balance-sheet strength, measured by debt to cash flows is a key metric used by conservative firms to manage their investment strategies.

In our data analysis, we use balance-sheet strength (based on debt to cash flows) to separate firms and find that conservative firms achieve higher production efficiency on average than other firms. This advantage in production efficiency is greater in down-cycle periods. Moreover, we find that the investment pattern for conservative firms based on capital expenditures reflects a conservative strategy for such firms. We find that conservative firms buy better than aggressive firms – obtaining more proven reserves based on their capital expenditures. This in turn leads to higher productive efficiency.

Our findings indicate the usefulness of debt to cash flows in financial statement analysis, not simply as a measure of financial risk, but also captures information about investment strategy. There are a number of directions future research could take. The two investment strategies (aggressive and conservative) appear to be representative of investment strategies in the O&G industry, future research may expand this analysis to other industries.

The fact that both strategies co-exist indicates that they each have costs and benefits. There is potential for developing an analytical model that would help explain the presence of both investment strategies. There is also potential for comparing the cumulative returns earned over time by firms following both strategies.

## Appendix I: Variable Definition

| Variables | Definitions |
|---|---|
| Conservative | Strategy based on the firm's average percentile rank of total debt to operating cash flows for the years the firm is in the data. If the average percentile rank is below the 50$^{th}$ percentile, the firm is classified as conservative.<br>An indicator variable: 1 for conservative strategy (below the 50th percentile) and 0 for aggressive strategy |
| ln(Score) | Efficiency score estimated from input-oriented variable returns to scale data envelopment analysis. Outputs are oil and gas production in BOE, inputs are total production expenses, general and administrative expenses, depreciation, depletion and amortization. All costs items are deflated by Canadian CPI index corresponding to the reporting month end. We log-transform all input and output variables. |
| ln(Production) | log of (total production of BOE of oil and gas +1) |
| ln(BTM) | Book value of total shareholder equity divided by market value of equity at the end of the quarter (year) |
| ln(DTE) | Book value of total debt divided by book value of equity at the end of the quarter (year) |
| CAPEX/TA | Capital expenditures for the period divided by total assets |
| OCF/TA | Operating cash flows divided by total assets |
| OCF/Debt | Operating cash flows divided by total debts Ln(CAPEX): log of (total capital expenditures by company including property and corporate acquisitions and net of dispositions + 1) |
| ln(CAPEX): | log of (net capital expenditure including property and corporate acquisitions and net of dispositions net of dispositions +1) |
| ln(Ac.Proven) | log of (total acquisition of proven reserves +1) |
| Post 2008 Financial Crisis | indicator variable 1 after 2008 Q2 and before 2014 Q3, 0 otherwise |
| Post 2014 price decline | indicator variable 1 after 2014 Q3, 0 otherwise |

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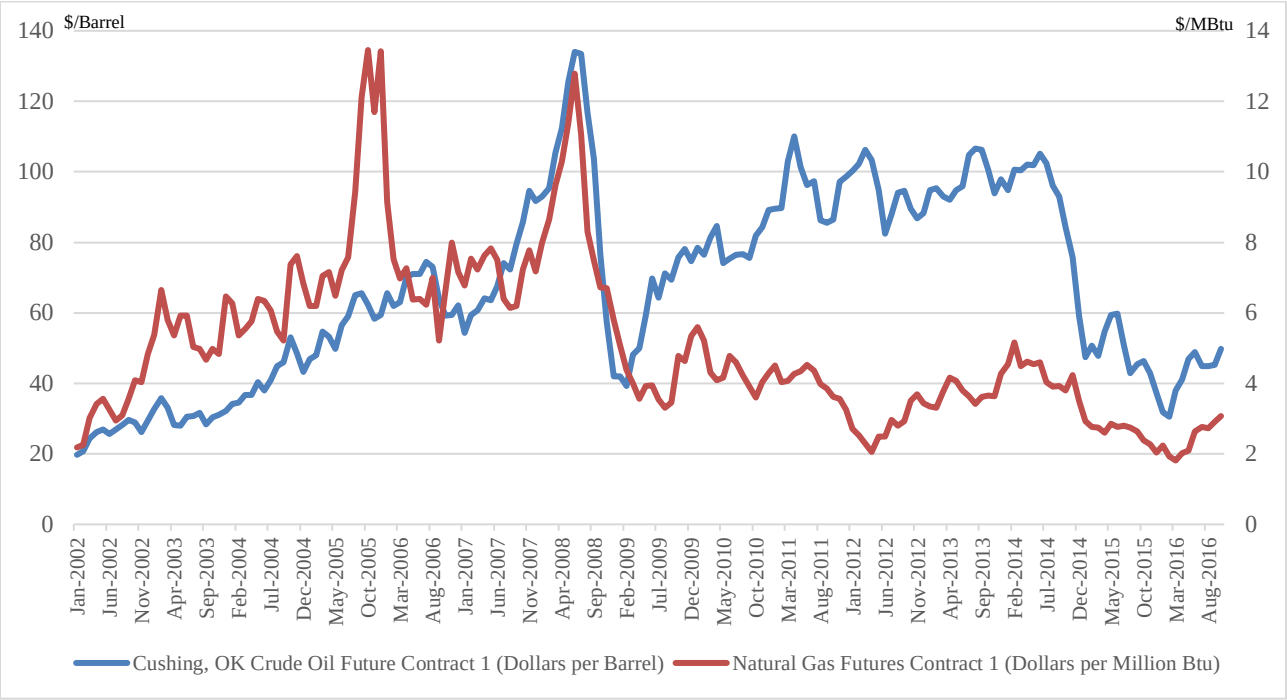
**Figure 1. Oil and Gas Prices from 2002 to 2016**




Data Source: Energy Information Admiration (http://www.eia.gov/)

**Table 1: Descriptive Statistics**

Panel A presents the descriptive analysis results for main variable, and Panel B reports the statistics for the comparison of two strategy groups. Variable definitions are presented in Appendix I. The testing period is from 2002 to 2016.

PANAL A: **Descriptive Statistics**

| **Quarterly Variable** | **N** | **Mean** | **Q1** | **Median** | **Q3** | **Std dev** |
|---|---|---|---|---|---|---|
| ln(Score) | 7,150 | -0.63 | -0.80 | -0.70 | -0.45 | 0.26 |
| ln(Production) | 7,150 | 8.08 | 6.53 | 8.11 | 9.78 | 2.38 |
| ln(BTM) | 7,150 | -0.30 | -0.84 | -0.35 | 0.22 | 0.94 |
| ln(DTE) | 7,150 | -1.03 | -1.56 | -0.95 | -0.42 | 1.16 |
| ROA | 7,150 | -0.02 | -0.02 | 0.00 | 0.02 | 0.11 |
| Capex/AT | 7,150 | 0.07 | 0.02 | 0.04 | 0.09 | 0.08 |
| OCF/TA | 7,150 | 0.03 | 0.01 | 0.03 | 0.05 | 0.03 |
| OCF/Debt | 7,150 | 0.23 | 0.05 | 0.13 | 0.24 | 1.53 |
| Conservative | 7,150 | 0.67 | 0.00 | 1.00 | 1.00 | 0.47 |
| **Annual Variable** | | | | | | |
| ln(CAPEX) | 1,954 | 9.29 | 7.82 | 9.55 | 11.21 | 3.118 |
| ln(Ac.Proven) | 1,954 | 7.92 | 0 | 10.69 | 14.67 | 7.27 |

PANAL B: **Comparison of Two Strategy Groups**

| | **Conservative** | | **Aggressive** | | | |
|---|---|---|---|---|---|---|
| **Quarterly Variable** | N | Mean | N | Mean | Diff | p-value |
| ln(Score) | 4,779 | -0.55 | 2,371 | -0.78 | 0.23 | <0.01 |
| ln(Production) | 4,779 | 8.97 | 2,371 | 6.30 | 2.67 | <0.01 |
| ln(BTM) | 4,779 | -0.32 | 2,371 | -0.26 | -0.06 | 0.02 |
| ln(DTE) | 4,779 | -1.16 | 2,371 | -0.75 | -0.42 | <0.01 |
| ROA | 4,779 | 0.00 | 2,371 | -0.05 | 0.05 | <0.01 |
| Capex/AT | 4,779 | 0.07 | 2,371 | 0.06 | 0.00 | 0.06 |
| OCF/TA | 4,779 | 0.04 | 2,371 | 0.01 | 0.03 | <0.01 |
| OCF/Debt | 4,779 | 0.34 | 2,371 | 0.01 | 0.33 | <0.01 |
| **Annual Variable** | | | | | | |
| ln(CAPEX) | 1,296 | 10.23 | 658 | 7.44 | 2.79 | <0.01 |
| ln(Ac.Proven) | 1,296 | 9.57 | 658 | 4.66 | 4.91 | <0.01 |

**Table 2: The Analysis of Efficiency Scores and Capital Expenditures Relative to Total Assets**

The testing period is from 2002 to 2016. Variable definitions are presented in Appendix I. T-statistics (reported in parentheses) are based on clustered standard errors (firm level). ***, **, and * indicate significance at the 1%, 5% and 10% levels, respectively.

| Variables | **(1)**<br>**ln(Score)** | **(2)**<br>**Capex/TA** |
|---|---|---|
| Conservative | 0.116*** | -0.026*** |
| | (0.031) | (-0.009) |
| Conservative*Post 2008 Financial Crisis | 0.087*** | 0.023** |
| | (0.024) | (0.011) |
| Conservative*Post 2014 Financial Crisis | 0.092** | 0.025*** |
| | (0.041) | (0.010) |
| ln(BTM) | -0.031*** | -0.012*** |
| | (-0.010) | (-0.004) |
| OCF/TA | 2.023*** | 0.200 |
| | (0.273) | (0.195) |
| ln(DTE) | 0.025*** | -0.003 |
| | (0.006) | (-0.002) |
| Quarter Fixed Effects | Yes | Yes |
| Num. obs. | 7,150 | 7,150 |
| Adj. $R^2$ | 0.280 | 0.102 |

**Table 3: Analysis of Acquisition of Proven Reserves**

$$\begin{cases} (1) ln(Ac.Proven) = \alpha_1 ln(Capex) + \alpha_2 Conservative + \alpha_3 Conservative * Post2008 \\ \qquad\qquad + \alpha_4 Conservative * Post2014 + \lambda_t + \varepsilon_{it} \\ (2) ln(Capex) = \beta_1 Conservative + \beta_2 Conservative * Post2008 \\ \qquad\qquad + \beta_3 Conservative * Post2014 + \gamma_t + \omega_{it} \end{cases}$$

The testing period is from 2002 to 2016. Variable definitions are presented in Appendix I. We estimate standard errors from clustered bootstrap with 1,000 replications to test non-linear hypotheses. ***, **, and * indicate significance at the 1%, 5% and 10% levels, respectively.

| | **(1)**<br>**ln (Ac.Proven)** | **(2)**<br>**ln(Capex)** |
|---|---|---|
| ln(Capex) | 0.827*** | |
| | (0.096) | |
| Conservative | 1.768** | 1.872*** |
| | (0.724) | (0.442) |
| Conservative*Post 2008 Financial Crisis | 0.668 | 1.202*** |
| | (0.726) | (0.385) |
| Conservative *Post 2014 Price Decline | 2.367** | 1.007* |
| | (1.100) | (0.514) |
| ln(BTM) | 0.146 | -0.321** |
| | (0.234) | (-0.140) |
| OCF/TA | 4.149 | 6.608** |
| | (3.038) | (3.363) |
| ln(DTE) | 0.498*** | 0.128* |
| | (0.146) | (0.075) |
| Quarter Fixed Effects | Yes | Yes |
| Nonlinear Hypotheses Tests | Est. | t-stat |
| $\beta_1*\alpha_1=0$ | 1.553 | 3.67 |
| $\beta_2*\alpha_1=0$ | 0.989 | 3.05 |
| $\beta_3*\alpha_1=0$ | 0.831 | 1.92 |
| Num. obs. | 1,954 | 1,954 |
| Adj. $R^2$ | 0.227 | 0.220 |

**Table 4 Robustness Test Using Split Sample**

The testing period is from 2002 to 2016. Variable definitions are presented in Appendix I. T-statistics (reported in parentheses) are based on clustered standard errors (firm level). ***, **, and * indicate significance at the 1%, 5% and 10% levels, respectively.

| | (1)<br>ln(Score)<br>OCF-to-Debt>0 | (2)<br>ln(Score)<br>OCF-to-Debt<0 |
|---|---|---|
| ln(OCF-to-Debt) | 0.032*** | |
| | (0.011) | |
| Post 2008 Financial Crisis*ln(OCF-to-Debt) | 0.022 | |
| | (0.016) | |
| Post 2014 Price Decline*ln(OCF-to-Debt) | 0.049** | |
| | (0.021) | |
| ln(- OCF-to-Debt) | | 0.001 |
| | | (0.013) |
| Post 2008 Financial Crisis*ln(- OCF-to-Debt) | | -0.026* |
| | | (-0.014) |
| Post 2014 Price Decline*ln(- OCF-to-Debt) | | -0.017 |
| | | (-0.025) |
| Quarter fixed effects | Yes | Yes |
| Num. obs. | 7,173 | 2,138 |
| Adj. $R^2$ | 0.03 | 0.065 |